

Substitute Specification and Claims
Filed 9-29-06

CLAIMS

1. A fail-safe circuit for piezo-operated gas valves, the fail-safe circuit comprising at least one input that can be connected to a control device and at least one output that can be connected to a gas valve, where the fail-safe circuit only supplies an output voltage to open a gas valve to the at least one output if an input signal containing at least two different successive frequency signals is provided by the control device at an input of the fail-safe circuit.

2. The fail-safe circuit of claim 1 comprising a charging circuit, which has at least one capacitor, where the charging circuit charges the at least one capacitor in the charging circuit when a first frequency signal is applied or is present in the input signal.

3. The fail-safe circuit of claim 2, wherein the charging circuit charges the at least one capacitor of the same only when the first frequency signal is present in the input signal.

4. The fail-safe circuit of claim 3, wherein the charging circuit does not charge the at least one capacitor in the charging circuit when a second frequency signal is applied or is present in the input signal, the second frequency signal having a lower frequency than the first frequency signal.

5. The fail-safe circuit of claim 4, wherein the at least one capacitor in the charging circuit discharges when the second frequency signal is applied or is present in the input signal.

6. The fail-safe circuit of claim 5 comprising a voltage transformer circuit, which produces an output

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voltage to open the gas valve from a supply voltage when the second frequency signal is applied or is present in the input signal.

7. The fail-safe circuit of claim 6, wherein the voltage transformer circuit has at least one capacitor, which charges when the second frequency signal is present in the input signal.

8. The fail-safe circuit of claim 7, wherein the at least one capacitor of the voltage transformer circuit continues to provide an output voltage to keep the gas valve open for a period of time when the first frequency signal is present in the input signal.

9. The fail-safe circuit of claims 6, wherein the voltage transformer circuit has a transistor having a base that is connected via a resistor to the capacitor of the charging circuit, where the transistor of the voltage transformer circuit only conducts if the capacitor of the charging circuit discharges when the second frequency signal is applied in the input signal.

10. The fail-safe circuit of claim 1, wherein the first frequency signal has a frequency of about 500 kHz and the second frequency signal has a frequency of about 10 kHz, and where the two frequency signals are applied successively in the input signal in such a way that a time period of about 30 milliseconds with the first frequency signal of about 500 kHz is respectively followed by a time period of about 100 milliseconds with the second frequency signal of about 10 kHz.

11. The fail-safe circuit of claim 1, wherein the first frequency signal and the second frequency signal are applied successively in the input signal in such a way that a first time period with the first

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frequency signal is respectively followed by a second time period with the second frequency signal.

12. A fail-safe circuit for gas valves, the fail-safe circuit comprising:

at least one input that can be connected to a gas valve controller;

at least one output that can be connected to a control input for a gas valve; and

the fail-safe circuit configured to only supply an output signal to open the gas valve via the at least one output of the fail safe circuit if/when the gas valve controller provides an input signal having at least two different frequency signals to the at least one input of the fail-safe circuit.

13. The fail-safe circuit of claim 12 wherein the fail-safe circuit is configured to only supply an output signal to open the gas valve via the at least one output of the fail safe circuit when the gas valve controller provides an input signal that includes a first frequency signal that is coordinated in time with a second frequency signal.

14. The fail-safe circuit of claim 12 wherein the fail-safe circuit is configured to only supply an output signal to open the gas valve via the at least one output of the fail safe circuit if/when the gas valve controller provides an input signal that includes a first frequency signal for a first period of time followed by a second frequency signal for a second period of time.

15. The fail-safe circuit of claim 14 wherein the fail-safe circuit is configured to only supply an output signal to open the gas valve via the at least one output of the fail safe circuit if/when the first frequency signal is not supplied during the second period

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of time, and the second frequency signal is not supplied during the first period of time.

16. A method for controlling a gas valve, the method comprising the steps of:

determining if a gas valve controller is currently providing a valid gas valve control signal;

operating the gas valve in accordance with the gas valve control signal if the determining step determines that the gas valve controller is currently providing a valid gas valve control signal; and

closing the gas valve if the determining step determines that the gas valve controller is not currently providing a valid gas valve control signal.

17. The method of claim 16 wherein the determining step includes determining if the gas valve controller is providing an input signal that includes a first frequency signal for a first period of time followed by a second frequency signal for a second period of time.

18. The method of claim of claim 17 wherein the determining step further determines if the first frequency signal is or is not supplied during the second period of time, and the second frequency signal is or is not supplied during the first period of time.

19. The method of claim 17 further comprising the steps of:

charging a capacitor of a charging circuit during the first period of time when the input signal includes the first frequency signal;

charging a capacitor of a transformer circuit during the second period of time when the input signal includes the second frequency signal, wherein a voltage

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across the capacitor of the transformer circuit opens the gas valve.

20. The method of claim 19 further comprising the steps of:

not charging the capacitor of the charging circuit during the second period of time, and using a voltage across the capacitor of the charging circuit to activate the transformer circuit during the second period of time.